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Dickens

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[54] **DATE FORMATTING AND SORTING FOR DATES SPANNING THE TURN OF THE CENTURY**

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[51] **Int. Cl.**^{6} **G06F 17/30**

[52] **U.S. Cl.** **707/6**; 707/102; 707/7; 707/200

[58] **Field of Search** 707/6, 102, 7, 707/200

[56] **References Cited**

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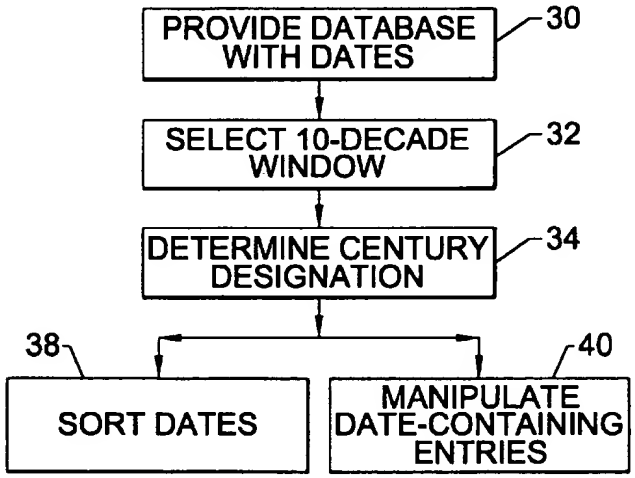
Attorney, Agent, or Firm—Bell Seltzer Intellectual Property Group of Alston & Bird LLP

[57] **ABSTRACT**

Dates stored in symbolic form in a database are reformatted to permit easy manipulation and sorting of date-related information. Each date in M_1M_2, D_1D_2, and Y_1Y_2 format is converted to C_1C_2, Y_1Y_2, M_1M_2, and D_1D_2 format. To accomplish the conversion, a 10-decade window starting on Y_AY_B is defined that encompasses all dates in the database. The value of C_1C_2 is determined by the relative values of Y_1Y_2 and Y_AY_B. The reformatted date information is particularly useful when the reformatting is in $C_1C_2Y_1Y_2M_1M_2D_1D_2$ format, because sorting by date is accomplished using a pure numerical-value sort.

15 Claims, 1 Drawing Sheet



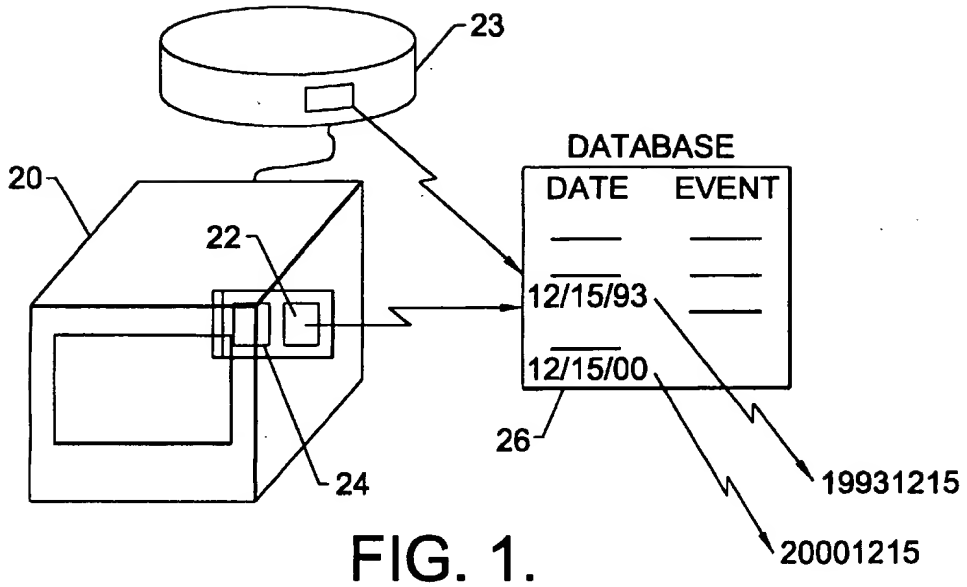

23
DATABASE
DATE
EVENT
20
22
12/15/93
12/15/00
26
24
19931215
20001215

FIG. 1.

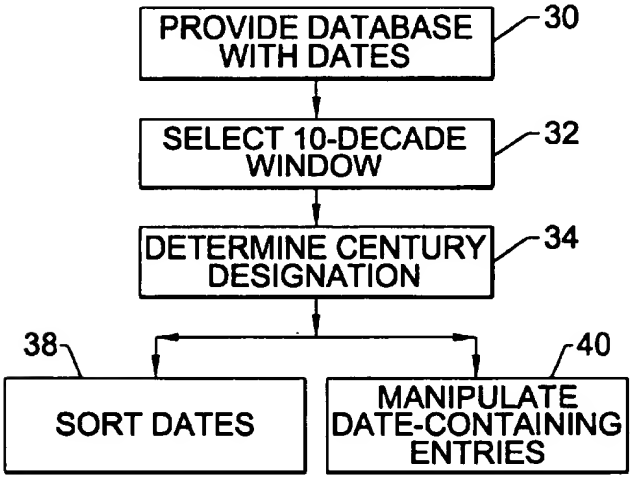

PROVIDE DATABASE WITH DATES
30
SELECT 10-DECADE WINDOW
32
DETERMINE CENTURY DESIGNATION
34
38
40
SORT DATES
MANIPULATE DATE-CONTAINING ENTRIES

FIG. 2.

DATE FORMATTING AND SORTING FOR DATES SPANNING THE TURN OF THE CENTURY

BACKGROUND OF THE INVENTION

This invention relates to the manipulation of information in a database, and, in particular, to the determination of dates in a useful form.

Dates are stored as symbolic representations in computer databases in varying formats. For example, a date may be represented in the numerical representation MM/DD/YY, where MM is a two-digit month designator, DD is a two-digit day designator, and YY is a two-digit year designator (the last two digits of the year). Thus, Dec. 15, 1993 is designated as 12/15/93. A date may also be represented in an alphanumeric form MMM/DD/YY, where MMM is an alphabetic month designator (e.g., DEC for December), and DD and YY are the same as in the numerical form. Dec. 15, 1993 is represented in this format as DEC/15/93.

Such approaches for the representation of dates have worked well since the advent of computer databases, which has occurred in the twentieth century. Dates may be sorted in chronological order using the numerical representations. However, with the turn of the century at Jan. 1, 2000, the representation and utilization of dates becomes more complex. Using the numerical form above, Dec. 15, 2000 is represented as 12/15/00. If a numerical sort is performed on 12/15/93 and 12/15/00, the later date 12/15/00 sorts as the first-occurring date, an incorrect result.

Sets of dates spanning the turn of the century and associated with past, current, and future activities are now stored in many databases. When stored in the conventional formats discussed above, those dates will not readily be used and numerically sorted in chronological order. They may be manually converted to a more usable form in the sense that programs may be written to perform conversions, manipulations, and sorting. However, these programs typically require additional data fields for storage, which may be objectionable in some circumstances.

There is a need for an improved approach to the representation and utilization of dates in databases, and for converting the existing dates in databases to a more usable form. The present invention fulfills this need, and further provides related advantages.

SUMMARY OF THE INVENTION

The present invention provides an approach to the representation and utilization of dates stored symbolically in databases. Existing symbolic date representations are converted to a more useful form of symbolic date representations without the addition of new data fields, and in a manner that is performed automatically by the computer and requires no user input. The approach of the invention permits direct numerical sorting of dates.

In accordance with the invention, a method of processing dates stored in a database comprises the steps of providing a database with dates stored therein according to a format wherein M_1M_2 is the numerical month designator, D_1D_2 is the numerical day designator, and Y_1Y_2 is the numerical year designator, all of the dates falling within a 10-decade period of time. A 10-decade window with a Y_AY_B value for the first year of the ten-decade window is selected, Y_AY_B being no later than the earliest Y_1Y_2 year designator in the database. A century designator C_1C_2 is determined for each date in the database, C_1C_2 having a first value if Y_1Y_2 is less than Y_AY_B and having a second value if Y_1Y_2 is equal to or greater than Y_AY_B Each date in the database is formatted with the values C_1C_2, Y_1Y_2, M_1M_2, and D_1D_2.

In the case of most practical interest, the 10-decade period of time spans the year 2000 and begins with a year in which the second digit (Y_B in Y_AY_B) is 0 (zero). For any 10-decade period including the year 2000, if the decade designator Y_1 of the date in the database is numerically less than the decade designator Y_A of the first decade of the 10-decade period of time, the century designator C_1C_2 is "20". If Y_1 is equal to or greater than Y_A, C_1C_2 is "19". Dates in databases spanning more than 10 decades are not handled by this approach, but it is not expected that this limitation will be significant for most commercial and industrial databases.

This approach works particularly well if the dates are represented in the format $C_1C_2Y_1Y_2M_1M_2D_1D_2$. The date Dec. 15, 2000 is represented in this format as 20001215, for example. Dates represented in this format may be directly sorted numerically by fast sorting techniques, and thereafter stored back in the database.

The present invention thus provides an efficient approach to converting and utilizing symbolic date representations in databases, which allows automatic processing of dates ranging from before to after the year 2000. The large number of dates represented in some databases may thereby be readily processed and utilized. Other features and advantages of the present invention will be apparent from the following more detailed description of the preferred embodiment, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention. The scope of the invention is not, however, limited to this preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic representation of a computer database with date information therein; and

FIG. 2 is a block flow diagram of a preferred approach for practicing the approach of the invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 schematically depicts a computer **20** having a read-only or random-access memory **22**, a mass-storage device **23**, and a central processing unit **24** therein. Stored in the memory **22** or on the mass-storage device **23** is a database **26**. The database includes information in the form of symbolic representations of dates and associated information such as events occurring on the respective dates. In a conventional approach, the dates are stored in a format such as $M_1M_2/D_1D_2/Y_1Y_2$ format. M indicates month information, D day information, and Y year information, with the subscript 1 or 2 indicating the first or second digit of the designator, respectively. Dec. 15, 1993 is stored as 12/15/93 or 12-15-93, and Dec. 15, 2000 is stored as 12/15/00 or 12-15-00, for example. If a numerical sort is performed on these dates, 12/15/00 will sort chronologically prior to 12/15/93.

FIG. 2 illustrates the approach of the invention. The computer database **26** is provided, numeral **30**, having symbolic representations of dates stored therein. In some cases, the dates will be represented as discussed in the preceding paragraph. In other cases, an alphanumeric designator is used. In that approach, each date is stored as $M_aM_bM_c/D_1D_2/Y_1Y_2$ format, where $M_aM_bM_c$ is an alphabetical symbol such as JAN for January, FEB for February,

etc. In that case, the month designator $M_aM_bM_c$ is first converted to the numerical form M_1M_2 by converting JAN to "01", FEB to "02", etc.

A 10-decade window is selected, numeral **32**. That is, it is necessary that all dates in the database will be within some period of 10 decades, or 100 years. This limitation poses little problem for most industrial and commercial databases. The window may be arbitrarily selected. For example, the decade could begin with the 1950's and end with the 2040's, or it could begin with the 1980's and end with the 2070's. The 10-decade window will normally include some decades from the prior century and some from the new century.

The first year of the 10-decade window is represented by Y_AY_B. In a commonly utilized application, Y_B is 0 (zero), although the invention is not limited to this case. That is, the 1950's first decade would be represented by Y_A0 of "50", and the 1980's first decade would be represented by Y_A0 of "80". For this case, a century designator C_1C_2 for a date is determined, numeral **34**, by comparing the value of Y_1, the first digit of the year designator for the date, with Y_A, the first digit of the first decade of the 10-decade window. C_1C_2 is assigned a first value if Y_1 is less than Y_A and a second value if Y_1 is equal to or greater than Y_A.

In the case of most interest, the 10-decade window includes decades earlier than the year 2000 and decades later than the year 2000, and Y_B is zero C_1C_2 is assigned "20" if Y_1 is less than Y_A and is assigned "19" if $Y_1$is equal to or greater than Y_A. In that case and for example, if Y_A is **5**, meaning that the decade beginning in 1950 was selected as the first decade of the 10-decade window, and if Y_1Y_2 is "43", the century designator C_1C_2 is "20", indicating that the year in question in the database is 2043. On the other hand, if Y_1Y_2 is "63", the century designator C_1C_2 is "19", indicating that the year in question in the database is 1963. This selection process is performed in a completely automated fashion by the computer, without human input other than to select the starting date of the 10-decade window.

The symbolic representations of the dates in the database are reformatted with the values C_1C_2, Y_1Y_2, M_1M_2, and D_1D_2, numeral **36** of FIG. **2**. In one case that produces particularly advantageous results for many operations, such as chronological date sorting, the date is represented in the form $C_1C_2Y_1Y_2M_1M_2D_1D_2$. For example, the date 12/15/93 (Dec. 15, 1993) is represented as 19931215 and the date 12/15/00 (Dec. 15, 2000) as 20001215. A straightforward numerical sort of date data fields expressed in this form produces an accurate chronological ordering.

Once the symbolic representations of the dates are reformatted according to the procedures set forth above, the date information may be sorted, numeral **38**, or otherwise manipulated, numeral **40**, together with the entries associated with the dates. Such manipulation may include handling of data associated with the dates, storing the dates and associated information back in the data base, or other processes.

The approach of the invention has been implemented in a computer program, a copy of which is attached as Exhibit A. This program converts dates both before and after the year 2000.

The present invention provides an effective technique for reformatting symbolic representations of date information that is rapid and automated, and yields new symbolic representations of date information that are particularly amenable to further processing. Although a particular embodiment of the invention has been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

What is claimed is:

1. A method of processing symbolic representations of dates stored in a database, comprising the steps of

providing a database with symbolic representations of dates stored therein according to a format wherein M_1M_2 is the numerical month designator, D_1D_2 is the numerical day designator, and Y_1Y_2 is the numerical year designator, all of the symbolic representations of dates falling within a 10-decade period of time;

selecting a 10-decade window with a Y_AY_B value for the first decade of the window, Y_AY_B being no later than the earliest Y_1Y_2 year designator in the database;

determining a century designator C_1C_2 for each symbolic representation of a date in the database, C_1C_2 having a first value if Y_1Y_2 is less than Y_AY_B and having a second value if Y_1Y_2 is equal to or greater than Y_AY_B; and

reformatting the symbolic representation of the date with the values C_1C_2, Y_1Y_2, M_1M_2 , and D_1D_2 to facilitate further processing of the dates.

2. The method of claim **1**, wherein the 10-decade window includes the decade beginning in the year 2000.

3. The method of claim **2**, wherein the step of determining includes the step of

determining the first value as 20 and the second value as 19.

4. The method of claim **1**, including an additional step, after the step of reformatting, of

sorting the symbolic representations of dates.

5. The method of claim **1**, wherein the step of reformatting includes the step of

reformatting each symbolic representation of a date into the format $C_1C_2Y_1Y_2M_1M_2D_1D_2$.

6. The method of claim **5**, including an additional step, after the step of reformatting, of

sorting the symbolic representations of dates using a numerical-order sort.

7. The method of claim **1**, wherein the step of providing a database includes the step of

converting pre-existing date information having a different format into the format wherein M_1M_2 is the numerical month designator, D_1D_2 is the numerical day designator and Y_1Y_2 is the numerical year designator.

8. The method of claim **1**, wherein the step of selecting includes the step of

selecting Y_AY_B such that Y_B is 0 (zero).

9. The method of claim **1**, including an additional step, after the step of reformatting, of

storing the symbolic representation of dates and their associated information back into the database.

10. The method of claim **9**, including the additional step, after the step of reformatting, of

manipulating information in the database having the reformatted date information therein.

11. A method of processing dates in a database, comprising the steps of

providing a database with dates stored therein according to a format wherein M_1M_2 is the numerical month designator, D_1D_2 is the numerical day designator, and Y_1Y_2 is the numerical year designator, all of dates falling within a 10-decade period of time which includes the decade beginning in the year 2000;

selecting a 10-decade window with a Y_AY_B value for the first decade of the window, Y_AY_B being no later than the earliest Y_1Y_2 year designator in the database;

determining a century designator C_1C_2 for each date in the database, C_1C_2 having a first value if Y_1Y_2 is less than Y_AY_B and having a second value if Y_1Y_2 is equal to or greater than Y_AY_B;

reformatting each date in the form $C_1C_2Y_1Y_2M_1M_2D_1D_2$ to facilitate further processing of the dates; and

sorting the dates in the form $C_1C_2Y_1Y_2M_1M_2D_1D_2$.

12. The method of claim **11**, wherein the step of providing a database includes the step of

converting pre-existing date information having a different format into the format wherein M_1M_2 is the numerical month designator, D_1D_2 is the numerical day designator and Y_1Y_2 is the numerical year designator.

13. The method of claim **11**, wherein the step of selecting includes the step of

selecting Y_AY_B such that Y_B is 0 (zero).

14. The method of claim **11**, including an additional step, after the step of sorting, of

storing the sorted dates and their associated information back into the database.

15. The method of claim **14**, including the additional step, after the step of sorting, of

manipulating information in the database having the reformatted date therein.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,806,063
DATED : September 8, 1998
INVENTOR(S) : Dickens

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On title page, item [56],

In the References Cited, OTHER PUBLICATIONS, line 1, before "The", insert --IBM: --.

In the ABSTRACT, line 4, "$_{M1}M_2$" should read --M_1M_2--.

Signed and Sealed this

Twenty-ninth Day of December, 1998

Attest:

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks